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ABSTRACT

This bulletin provides information about available training as well as information to assist supervisors and training officers in developing a coordinated, efficient training program in hydrology and other subjects related to water-resources investigations. Most of the training is presented at the Center at Lakewood, Colorado. Information is given relevant to the facilities and regional offices. A description of the three levels of training program is presented. A calendar running from July 1973 through June 1974 shows the various topics and activities that were encountered. A description of the specific activity, where and when it was to take place and attendees, is shown in detail in the bulletin. (EB)

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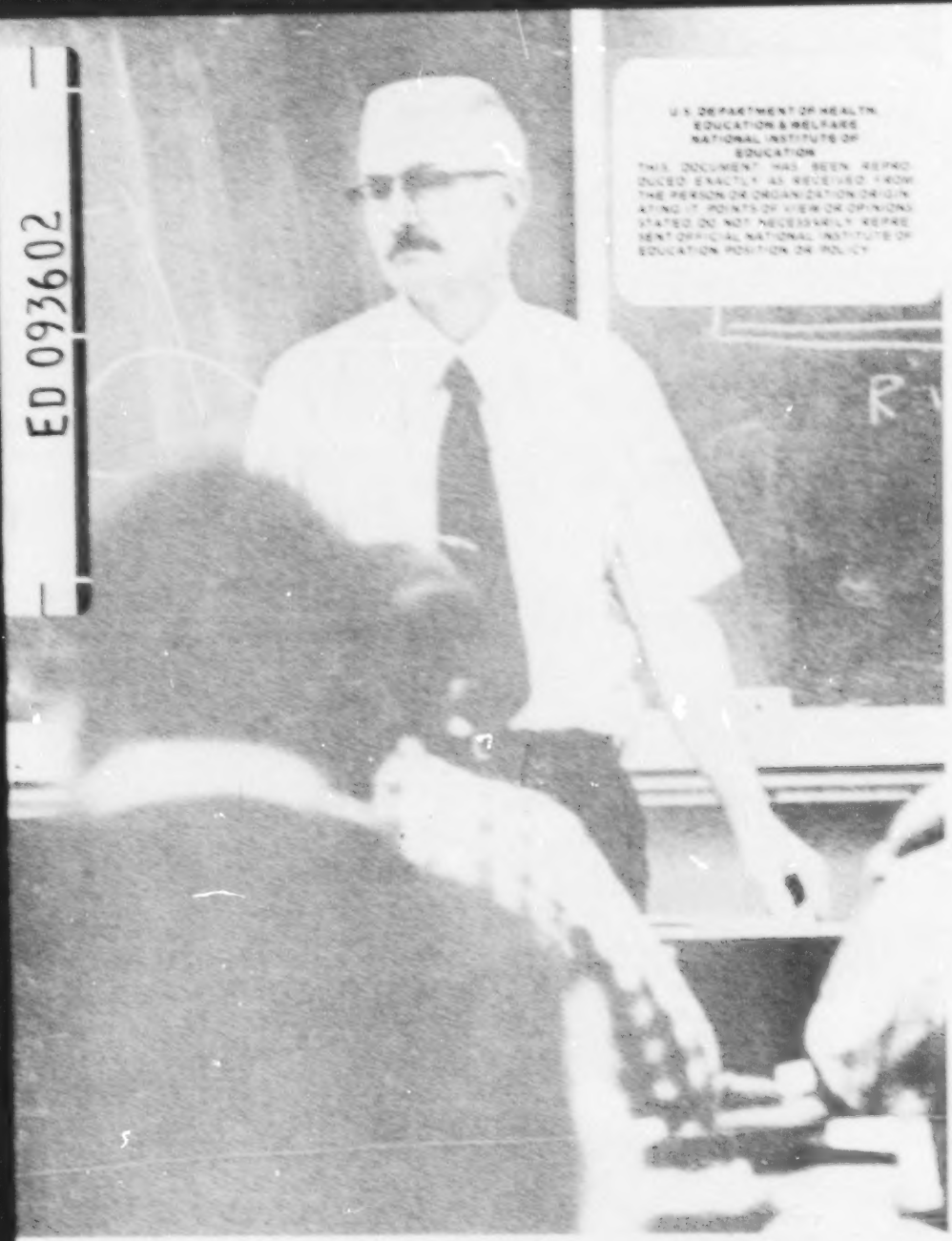

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Water Resources Division Training Bulletin

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July 1973 through June 1974

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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WATER RESOURCES DIVISION TRAINING BULLETIN JULY 1973 THROUGH JUNE 1974

BEST COPY AVAILABLE

By R. O. Abrams and D. W. Brown

U. S. DEPARTMENT OF THE INTERIOR
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1973

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W A T E R R E S O U R C E S D I V I S I O N
T R A I N I N G B U L L E T I N
J U L Y 1 9 7 3 T H R O U G H J U N E 1 9 7 4

By R. O. Abrams and D. W. Brown

INTRODUCTION

Purpose and Scope of This Bulletin

This bulletin is designed to inform interested personnel about training available through the Water Resources Division of the U.S. Geological Survey during the period July 1973 through June 1974. The information in this bulletin also can assist supervisors and training officers in developing a coordinated, efficient training program for the personnel for whom they are responsible.

The objective of the Water Resources Division training program is to provide specialized training in many phases of hydrology and other subjects related to water-resources investigations. The training courses featured in this bulletin are in specialized subjects that are not generally available elsewhere, including the latest developments in applications of ground-water, surface-water, and water-quality hydrologic methods in the field and in the laboratory. The training described herein provides rapid application of new research results, increases the skills of personnel, and trains newly recruited personnel in the special skills and methods required in water-resources investigations. The training courses will assist personnel in not only learning, reviewing, or expanding their knowledge of technical operations involved in various phases of hydrology and related subjects, but they will also foster an overall insight into the broad field of water-resources work.

Training Facilities

Most of the training is presented at the Water Resources Division Training Center at Lakewood, Colo. (fig. 1). The Training Center is located in Building 53 (fig. 2) at the

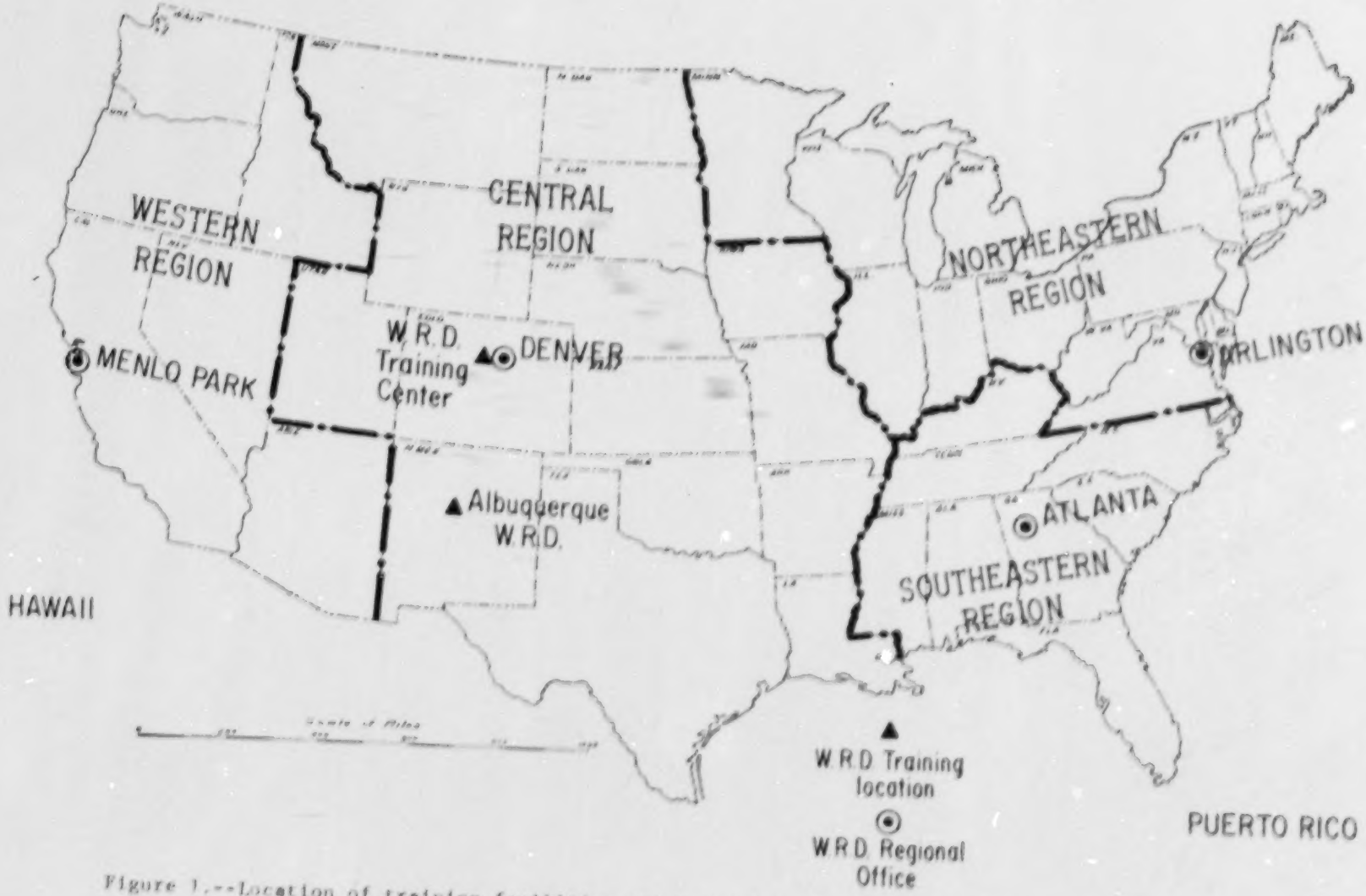

Figure 1.--Location of training facilities and Water Resources Division Regional Offices.

Denver Federal Center, which is near the intersection of U.S. Highway 6 (Sixth Avenue) and Kipling Street approximately 8 miles west of downtown Denver. Laboratory and lecture facilities at the Water Resources Division Training Center are air-conditioned, comfortably and pleasingly furnished, and well-equipped. Readily available is a wide variety of audio-visual aids, including closed-circuit and videotape television, as well as specialized instruments, equipment, and supplies needed for laboratory lecture room, and field studies.

Some of the training in fluvial-sediment analysis is given at the Water Resources Division's sediment laboratory at Albuquerque, New Mexico. Other specialized training is occasionally conducted at other locations.

The area around Denver provides the Water Resources Division Training Center with field conditions representative of both plains and mountain environment. Thus, a wide variety of geologic and hydrologic characteristics is available for field trips and field problems.

Training Staff

Scientists and engineers who are nationally, and often internationally, recognized authorities from the Water Resources Division serve as the main training staff for the training sessions. Experts from other divisions of the Geological Survey, other government agencies, universities, and industries, also serve as lecturers and special consultants.

DESCRIPTION OF TRAINING

The Level I training is for new professional and technical employees of the Water Resources Division. In addition, any part or parts of this training course can be used by personnel for review or broadening of skills. A detailed description of this training course will not be presented in this bulletin but the schedule of the course is shown in the training calendar (table 1). This training is presented at the Water Resources Division Training Center in Denver.

The Level II training is to develop the full performance level of the professional and technical employee. The

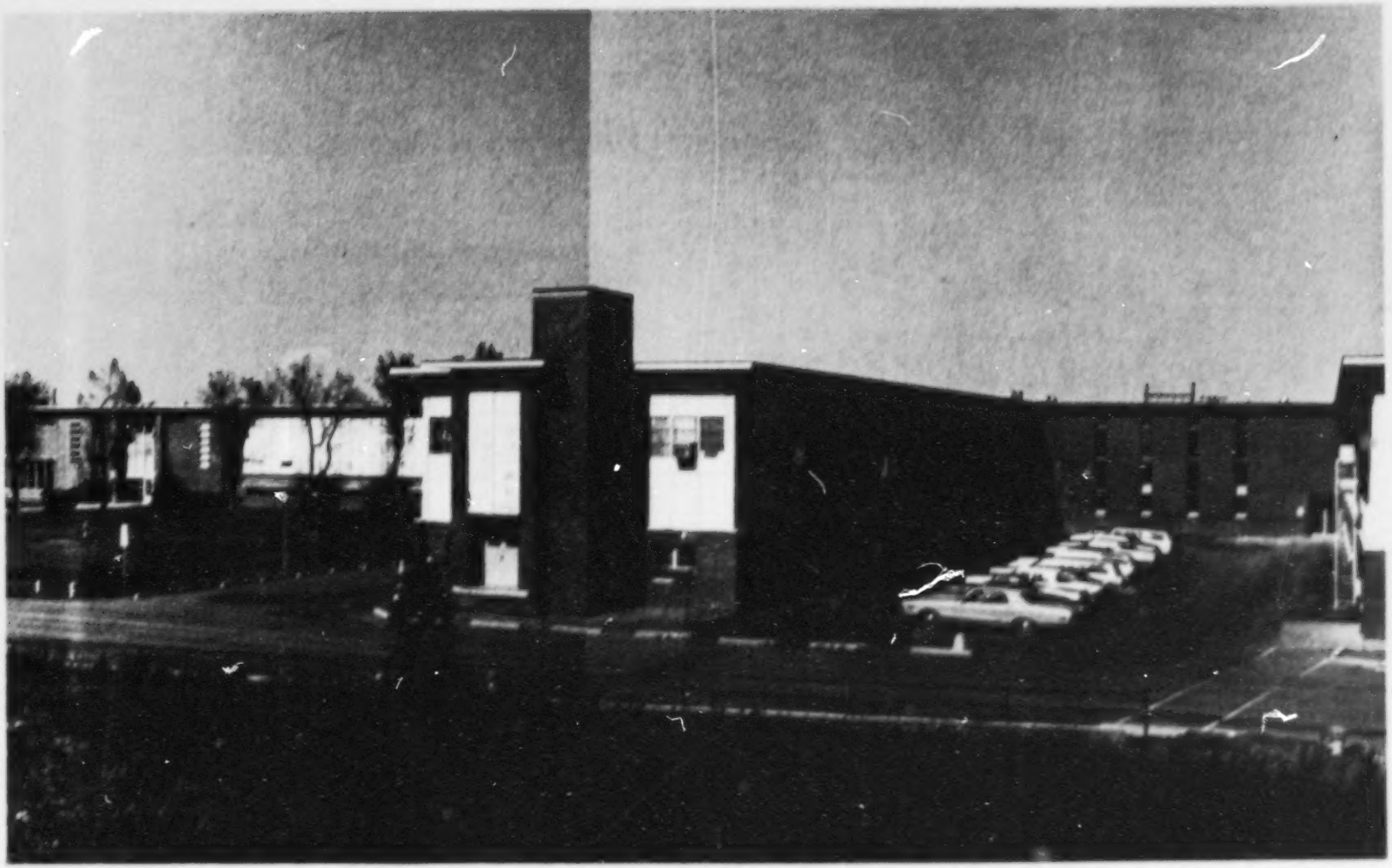

Figure 2.--The Water Resources Division Training Center is in Building 53 at the Denver Federal Center.

training will be in the general discipline areas of ground water, surface water, and quality of water.

The Level III training is to develop specialists within the Water Resources Division. The training will be presented at locations that have the necessary facilities and equipment for instruction.

Most of the training courses described in this bulletin are short-term seminars of 1- to 2-week's duration, but some courses are 4 weeks in duration. The schedule for training courses offered during the period July 1, 1973 through June 30, 1974 are presented in the training calendar (table 1) and described in detail in subsequent pages.

ADMISSION TO TRAINING SESSIONS

Some of the training is designed only for professional personnel, and some for technicians. In addition, some training sessions are designed primarily for international participants and some for both international and national personnel. Special capabilities and experience may be required of personnel attending some of the more advanced or highly specialized training sessions. All requirements for admission are listed with the detailed descriptions of the various training sessions.

Admission of Water Resources Division personnel to training courses is accomplished by the District Chief or Project Chief nominating candidates to the Regional Hydrologist at the appropriate Regional office. Each Regional Hydrologist then notifies the Chief, Manpower Section, WRD, Washington, D. C., with a copy to the Chief, Water Resources Division Training Center, Denver, Colo., of approved nominations for each training session. For some specialized training, nominations will be made by the Regional Hydrologists to the Chief, Manpower Section.

Admission of international participants to training sessions is accomplished by application to the Director, U.S. Geological Survey (Attention: Chief, Office of International Activities, WRD), Washington, D. C. 20242. Applications usually are transmitted through AID, UN, UNESCO, FAO, etc.

Admission of personnel from other Federal and State agencies is accomplished by application to the closest Water Resources Division office. That office in turn will obtain approval from the Chief, Manpower Section, WRD, through the appropriate Regional Hydrologist.

Early application for admission is advised since course attendance is always limited. All costs for housing, transportation, subsistence, etc., must be paid by the attendee's sponsoring office; none of these costs will be borne by the training facility. In a few cases, a tuition fee will be charged to cover extraordinary costs, such as computer time.

Applicants will be notified when admission has been approved. Information on housing and local transportation, exact location and time for training sessions, required supplies, and other pertinent information will be sent to accepted applicants in advance of their arrival at the training facility.

There is a travel equalization charge for WRD employees attending the WRD Training Center, Lakewood, Colorado. The charge has been established for each training course presented at the Training Center, based upon a per-diem rate of $25 per day times the length of the course including two travel days, plus $180 travel costs. As an example, the charge for a 5-day training course would be $355 per student. The charge includes travel and per diem costs only and does not include any other charges which may be incurred. If an attendee rents an automobile, it should still be charged to that individual's District or Project account. The charge applies only to WRD employees attending training as students; accounting procedures for instructors will remain the same. There will be no charge for participants from agencies other than WRD; however, the sending agency shall be responsible for all incurred costs of sending a participant to the training.

The following procedure will be used for billing purposes: When a District is notified by the WRD Training Center that a selection has been made, it shall credit by journal voucher to account number 4-4000-98500 an amount equal to the cost of that training session. Upon completion of the training session, the travel voucher covering travel costs and per diem for each training should be charged to account number 4-4000-98400. A copy of each journal voucher and travel voucher affecting the above accounts should be sent to the Manpower Section (Code 4100 3112) when the original is submitted to the Branch of Financial Management.

TABLE 1.--TRAINING CALENDAR, JULY 1973 THROUGH JUNE 1974

1973		Page
July 2 - 6	Open Date	
July 9 - 13	Open Date	
July 16 - 20	Open Date	
July 23 - 27	Open Date	
July 30 - August 3	HYDROLOGIC INSTRUMENTATION	10
August 6 - 17	DIGITAL MODELING OF STREAM SYSTEMS	10
August 20 - 24	WATER QUALITY FIELD TECHNIQUES	11
August 20 - 31	WORKSHOP ON LAKE LIMNOLOGY	11
August 27 - 29	PROJECT PLANNING AND SUPERVISION	12
September 3 - 7	Open Date	
September 10 - 14	DATA ACQUISITION FOR PROFESSIONALS	12
September 17 - 21	WATER QUALITY & WATER QUALITY PROGRAMMING FOR SUPERVISORS	12
September 24 - October 5	SURFACE WATER HYDRAULIC ANALYSIS	13
October 1 - 5	SEDIMENT DATA COLLECTION & LABORATORY ANALYSES	13
October 8 - 12	Open Date	
October 15 - 17	SURFACE WATER FOR SUPERVISORS	14
October 22 - 26	Open Date	
October 29 - November 9	SURFACE WATER HYDROLOGIC ANALYSIS	14
November 5 - 7	GROUND WATER FOR SUPERVISORS	15
November 12 - 16	COLLECTION OF WATER RESOURCES DATA FOR TECHNICIANS	15

TABLE 1.--TRAINING CALENDAR--continued

November 19 - 23	Open Date	
November 26 - December 5	REPORT WRITING AND REVIEW FOR AUTHORS	15
December 3 - 7	GROUND WATER - SURFACE WATER RELATIONSHIPS	16
December 10 - 14	COMPUTER PROGRAMMING	16
December 17 - 21	Open Date	
December 24 - 28	Open Date	
December 31 - January 4	Open Date	
1974		
January 7 - 11	ADVANCED SEMINAR IN ENVIRONMENTAL QUALITY	17
January 7 - April 5	HYDROLOGIC TECHNIQUES FOR NEW PROFESSIONAL EMPLOYEES	10
January 14 - 16	DECISION THEORY	17
January 21 - 25	NUMERICAL ANALYSIS	18
January 28 - February 1	DIGITAL MODELING OF GROUND WATER FLOW	18
February 4 - 15	GEOCHEMICAL MODELS OF GROUND-WATER SYSTEMS	19
February 18 - 22	Open Date	
February 25 - March 1	HYDROLOGY FOR TECHNICIANS	20
March 4 - 8	DATA ACQUISITION FOR PROFESSIONALS	20
March 11 - 15	HYDROLOGIC INSTRUMENTATION	20
March 18 - 29	SURFACE WATER HYDROLOGIC ANALYSIS	21
April 1 - 5	Open Date	

TABLE 1.--TRAINING CALENDAR--continued

April 8 - 12	ORGANIC SUBSTANCES IN WATER	21
April 8 - June 28	HYDROLOGIC TECHNIQUES FOR INTERNATIONAL PARTICIPANTS	21
April 15 - 19	COLLECTION OF WATER RESOURCES DATA FOR TECHNICIANS	22
April 22 - 26	EDITORIAL TECHNIQUES	22
April 22 - 26	ILLUSTRATION TECHNIQUES	23
April 29 - May 2	ANALYTICAL METHODS TO DETERMINE AQUIFER PROPERTIES	23
May 13 - 24	ADVANCED GROUND WATER COURSE	24
May 20 - 24	Open Date	
May 27 - 31	Open Date	
June 3 - 7	Open Date	
June 12 - 14	FLOOD MAPPING FROM AERIAL PHOTOGRAPHY	24
June 17 - 21	Open Date	
June 24 - 28	Open Date	

TABLE 2.--DESCRIPTION OF TRAINING COURSES

1974	LEVEL I
January 7-April 5	Description: HYDROLOGIC TECHNIQUES FOR NEW PROFESSIONAL EMPLOYEES OF THE WATER RESOURCES DIVISION. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: New professional personnel of the Water Resources Division, or experienced personnel desiring review or expansion of skills. A maximum of 20 attendees will be permitted.
1973	LEVEL II
July 30-August 3	Description: HYDROLOGIC INSTRUMENTATION. This workshop emphasizes theory of operation, and the trouble-shooting and maintenance of specialized equipment and instruments used in field studies; i.e., digital water-stage recorder; bubbler gage (servomanometer); water-quality monitors; portable water-quality instruments for measurement of pH, DO, specific conductance, and sampling; water-level equipment; special meteorological instruments. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Technicians and professionals of the Water Resources Division and its cooperators. A maximum of 24 attendees will be permitted.
August 6-17	Description: DIGITAL MODELING OF STREAM SYSTEMS. The training will provide lecture and workshop sessions on digital modeling of stream systems. Emphasis will be on the modeling approach to stream systems problems using well-known hydraulic techniques. In the training sessions a simplified stream systems problem will be coded, programmed, and run on the computer. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Must be (1) Water Resources Division employees; (2) should have demonstrated an

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

	aptitude and interest toward quantitative analysis of stream systems problems; and (3) will be required to have experience or training in programming scientific problems in FORTRAN IV and in use of digital computers. Mathematics training through ordinary differential equations is recommended. A maximum of 20 attendees will be permitted.
August 20-24	Description: WATER QUALITY FIELD TECHNIQUES. This course is aimed at providing training in field sampling techniques, sample preservation, principles of sampling-site selection, and in the use and calibration of field instruments used in all phases of sampling for water-quality data collection. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Division personnel actively engaged in collection and field analyses of water samples. These include both professional and technician grades. Attendance will be limited to 24.
August 20-31	Description: WORKSHOP ON LAKE LIMNOLOGY. The workshop will emphasize the practical conduct of limnological studies with special emphasis on the development of competence in lake techniques. Field endeavors will include the study of physical and chemical lake dynamics and of biological productivity. Attendees will be instructed on the proper design of limnological investigations. Location: The workshop is tentatively scheduled to be held at Lake Okaboji, Iowa. Attendees: Professionals who are actively engaged or will be engaged in lake studies. Attendance will be limited to 20.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

August 27-29	Description: PROJECT PLANNING AND SUPERVISION. This course is designed for lectures and active discussion by attendees on the planning, documentation, and supervision of projects and report management. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Professional and technical personnel who have or will have the responsibility for supervising and/or formulating projects. A maximum of 24 attendees will be permitted.
Sept. 10-14	Description: DATA ACQUISITION FOR PROFESSIONALS. This course will describe the types of water resources information needed, methods of data collection and analysis in the three basic disciplines, and the challenging opportunities in this field. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Mid-career and young professionals who may be assigned to this important component of the Division's program. Attendance will be limited to 20.
Sept. 17-21	Description: WATER QUALITY AND WATER QUALITY PROGRAMMING FOR SUPERVISORS. This course covers the philosophy of water-quality program design with emphasis on current problems relating to environmental implications. It will include some basic concepts of water quality as related to water resources investigations, including such questions as what is water quality and what is the role of the Geological Survey in defining water quality. The role of various forms of water-quality modeling is discussed as alternative to or complementary to data-collection programs. Problems relating to the development and conduct of water-quality programs by districts will be discussed in depth.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

	Location: Water Resources Division Training Center, Denver, Colorado. Attendees: This course is aimed at supervisory personnel who do not have academic training in water quality, but who are or who may be involved in the planning and programming of water resources investigations of which water quality may be a part. These include district or project chiefs and assistant district chiefs, or section chiefs. A maximum of 20 attendees will be permitted.
Sept. 24-Oct. 5	Description: SURFACE WATER HYDRAULIC ANALYSIS The seminar combines lectures with field investigations and analyses of surface-water hydraulic problems. The subject matter includes hydraulic theory and its applications to indirect measurements; rating of control structures; hydraulics of bridge and culvert openings; water-surface profiles by the step-backwater method; measurement of traveltime, dispersion, and flow by dye-dilution methods; measurement of flows in tidal reaches, and advance planning for data collection during and after major floods. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Middle-grade professionals who need to apply hydraulic principles in their present or future assignments. Attendance is limited to 20. Attendees should bring appropriate field clothing.
Oct. 1-1	Description: SEDIMENT DATA COLLECTION AND LABORATORY ANALYSES. This course is a workshop aimed at training in the fundamentals of sample collection, sediment concentration analyses, particle-size analyses, and computation of sediment-discharge records. Trainees will spend one day in the field collecting suspended-sediment and bed-material samples. They will analyze their samples in the laboratory for concentration and particle-size

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

	distribution and prepare the results for entry into the data files. A brief introduction of computation of sediment-discharge records will be included. Location: This course will be held at the sediment laboratory of the New Mexico district, Albuquerque, New Mexico. Attendees: Professionals and technicians who are actively engaged in sediment activities or those who plan to be actively engaged in the collection of sediment data in the near future. Attendance will be limited to 14.
Oct. 15-17	Description: SURFACE WATER FOR SUPERVISORS. A 3-day briefing on the philosophy of surface-water investigations and introduction to some of the most modern concepts and methods for studying surface water. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Division supervisory personnel with experience in ground-water and water-quality disciplines. These can include district or project chiefs and assistant chiefs, or section chiefs. A maximum of 24 attendees will be permitted.
Oct. 29-Nov. 9	Description: SURFACE-WATER HYDROLOGIC ANALYSIS. Explanation, discussion, and practice in practical solutions to hydrologic problems related to stream flow are provided. Principal subjects covered are: (1) regional analysis; (2) computer programs; (3) basin modeling; (4) alternatives to regionalization; (5) low-flow investigations; (6) storage analysis; (7) forecasting; (8) effect of land use on streamflow; (9) basin projects; (10) data collection system design; and (11) design of experiments. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Experienced surface-water specialists with some training in statistical methods in hydrology. Attendance is limited to 24.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

Nov. 5-7	Description: GROUND WATER FOR SUPERVISORS. A 3-day briefing on the philosophy of ground-water investigations, and introduction to procedures for planning a ground-water investigation, and discussion of hydrogeology. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Division supervisory personnel with experience in surface-water and water-quality disciplines. These can include district or project chiefs and assistant chiefs, or section chiefs. Attendance will be limited to 24 attendees.
Nov. 12-16	Description: COLLECTION OF WATER RESOURCES DATA FOR TECHNICIANS. This course is aimed at presenting a well-rounded interdisciplinary picture of the Water Resources Division activities in all aspects of water-data collection. Basic principles are emphasized throughout. Standard data-collection techniques based on principles of sampling and measurement are emphasized. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Technicians of the Water Resources Division or its cooperators who are involved in collecting and/or analyzing water-resources data. Attendance will be limited to 20, grades GS-6 and above.
Nov. 26-Dec. 5	Description: REPORT WRITING AND REVIEW FOR AUTHORS. Eight days of lectures, work exercises, and actual review of report manuscript provide concentrated exposure to all aspects of report writing and review for authors. Attendees will submit a draft manuscript for review during the session. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: New professional personnel of the Division, or experienced personnel desiring review or expansion of skills as authors. A maximum of 16 attendees will be permitted.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

Dec. 3-7	Description: GROUND WATER - SURFACE WATER RELATIONSHIPS. This seminar focuses on the utilization of stream-flow data in determining aquifer parameters, ground-water recharge, and the consumptive use of ground water by evapotranspiration. The techniques illustrated are also useful conversely for separating stream hydrographs, calculating rates of flow recession, and forecasting low flow. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Experienced professional personnel of the Water Resources Division. Attendance will be limited to 24.
Dec. 10-14	Description: COMPUTER PROGRAMMING. Content provides instruction and practice in basic programming in FORTRAN IV for the IBM/360 computer system. Short programs will be designed and written, cards punched and run through computer for checking individual exercises; advanced programming concepts will be presented; discussion, demonstration, and practice on time-sharing terminal; discussion of special class problems. Location: Water Resources Division Training Center, Denver, Colorado Attendees: Personnel of the Water Resources Division or its cooperators needing a basic introduction to FORTRAN IV computer programming for the IBM/360 computer. Attendance will be limited to 24.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

1974

Jan. 7-11

Description: ADVANCED SEMINAR IN ENVIRONMENTAL QUALITY. This seminar is designed to present interpretive water-quality oriented environmental studies. Emphasis is placed on applications rather than theory. Topics include program approaches and design, thermal pollution, organic geochemistry, biological indices, modeling, and others.
Location: Water Resources Division Training Center, Denver, Colorado.
Attendees: Division professional personnel who presently or will soon be engaged in interpretative, water-quality oriented, environmental studies. A maximum of 24 attendees will be permitted.

Jan. 14-16

Description: DECISION THEORY. Program management entails decision making under varying degrees of uncertainty as to program priorities and available resources. A formal structure of dealing with uncertainty through applications of statistical decision theory is to be presented. Particular attention is directed toward the philosophy of decision theory--statement of objectives and goals and measures of program effectiveness. How prior and subjective information is incorporated formally into decision making and the appraisal of the value of additional information is treated will be discussed.
Location: Water Resources Division Training Center, Denver, Colorado.
Attendees: The course is designed for District Chiefs and other professional employees at the GS-14 and above level who are involved with program management. Attendance will be limited to 24.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

Jan. 21-25	Description: NUMERICAL ANALYSIS. A review of the differential equations which describe both flow as well as mass transport in saturated ground-water flow will be discussed. The principles of solving the basic flow equations using digital computer techniques are presented. The methods covered include: (1) finite-difference methods for one- and two-dimensional flow problems--both implicit and explicit methods including the alternating direction technique, and (2) the Galerkin method for solving the mass transport equation. This workshop is designed as background for both the Digital Modeling of Ground Water Flow and the Geochemical Models of Ground Water Systems. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Attendees must (1) be Water Resources Division employees experienced in ground-water quantitative analysis, (2) be familiar with the differential equations of ground-water flow, (3) have programmed scientific problems using FORTRAN IV and have used digital computers. Attendance will be limited to 20.
Jan. 28-Feb. 1	Description: DIGITAL MODELING OF GROUND WATER FLOW. This course is designed to instruct and provide experience in the use of the WRD digital ground-water simulation model--the so-called "Pinder" model. A review of the basic differential equation of ground-water flow is presented. The theory, basic approach, and idiosyncrasies of the WRD model are discussed, including a discussion of data set-up and requirements. During the week, each student has the opportunity to use the model to make an analysis of a realistic aquifer problem. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Attendees must (1) be Water Resources Division employees experienced in ground-water

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

quantitative analysis, (2) be familiar with the differential equations of ground-water flow, (3) have a good knowledge of numerical analysis--we strongly urge that attendees without a very strong background attend the Numerical Analysis workshop (January 21-25), (4) have programmed scientific problems using FORTRAN IV and have used digital computers, and (5) be engaged in a project in which simulation can be applied within the next 1 or 2 years. Attendance will be limited to 20.

Feb. 4-15

Description: GEOCHEMICAL MODELS OF GROUND-WATER SYSTEMS. This is intended as a two-week course to quantatively investigate geochemical processes that occur during ground-water movement. Conservative and non-conservative transport, state of the art, models will be presented. The topics to be presented include: (1) the WRD mineral equilibria program and (2) multi-dimensional conservative and non-conservative transport models with dispersion by the following methods: (a) finite difference methods, (b) method of characteristics and (c) the Galerkin technique.

Location: Water Resources Division Training Center, Denver, Colorado.

Attendees: Attendees must (1) be Water Resources Division employees experienced in ground-water quantitative analysis, (2) be familiar with differential equations of flow, (3) have a background in chemistry or geochemistry, (4) have a good knowledge of numerical analysis--we strongly urge that attendees without a strong background attend the Numerical Analysis workshop (January 21-25), (5) have programmed scientific problems in FORTRAN IV and have used digital computers. Attendance will be limited to 20.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

Feb. 25-March 1	Description: HYDROLOGY FOR TECHNICIANS. The purpose of this course is to provide the technician of the Water Resources Division with a general knowledge and appreciation of the entire hydrologic field. To assist in the development and growth of the technician by giving him a general understanding of the nature and scope of scientific hydrology as it relates to water resources programs. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Technicians of the Water Resources Division and its cooperators. A maximum of 24 attendees will be permitted.
March 4-8	Description: DATA ACQUISITION FOR PROFESSIONALS. This course will describe the types of water resources information needed, methods of data collection, and analysis in the three basic disciplines, and the challenging opportunities in this field. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Mid-career and young professionals who may be assigned to this important component of the Division's program. Attendance will be limited to 20.
March 11-15	Description: HYDROLOGIC INSTRUMENTATION. This workshop emphasizes theory of operation, and the trouble-shooting and maintenance of specialized equipment and instruments used in field studies; i.e., digital water-stage recorder; bubbler gage(servomanometer); water-quality monitors; portable water-quality instruments for measurement of pH, DO, specific conductance, and sampling; water-level equipment; special meteorological instruments. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Technicians and professionals of the Water Resources Division and its cooperators. A maximum of 24 attendees will be permitted.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

March 18-29	Description: SURFACE WATER HYDROLOGIC ANALYSIS. Explanation, discussion, and practice in practical solutions to hydrologic problems related to stream flow are provided. Principal subjects covered are: (1) regional analysis; (2) computer programs; (3) basin modeling; (4) alternatives to regionalization; (5) low-flow investigations; (6) storage analysis; (7) forecasting; (8) effect of land use on streamflow; (9) basin projects; (10) data collection system design; and (11) design of experiments. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Experienced surface-water specialists with some training in statistical methods in hydrology. Attendance is limited to 24.
April 8-12	Description: ORGANIC SUBSTANCES IN WATER. This course is intended to provide background fundamentals and describe techniques available for studying the source, behavior, and fate of organic compounds in ground and surface waters. Both natural and man-made compounds are considered. Descriptions and techniques for sampling and sample processing, interpretation and display of data, and limitations of present analytical methods are discussed. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: District water-quality specialists and project personnel responsible for planning and executing water-quality studies. Attendance will be limited to 20.
April 8-June 28	Description: HYDROLOGIC TECHNIQUES FOR INTERNATIONAL PARTICIPANTS. A 12-week training course presenting the introductory fundamentals of the ground-water, surface-water, and water-quality disciplines. The ground water training includes (1) aquifer properties and hydrogeology, (2) ground-water exploration, and (3) ground-water hydraulics and aquifer tests.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

	The surface-water training includes measurement of discharge by direct and indirect methods, stage measurement; computation of streamflow records, hydrologic analysis of streamflow records, deterministic models, and measurement of influencing factors. The quality-of-water training includes fluvial-sediment techniques, basic water chemistry and microbiology, sample collection and preservation, organic chemistry, and geochemistry. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Professionals or technicians from the Water Resources Division or its cooperators, and international participants. A maximum of 24 attendees will be permitted.
April 15-19	Description: COLLECTION OF WATER RESOURCES DATA FOR TECHNICIANS. This course is aimed at presenting a well-rounded interdisciplinary picture of the Water Resources Division activities in all aspects of water-data collection. Basic principles are emphasized throughout. Standard data-collection techniques based on principles of sampling and measurement are emphasized. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Technicians of the Water Resources Division or its cooperators who are involved in collecting and/or analyzing water-resources data. Attendance will be limited to 20, grades GS-6 and above.
April 22-26	Description: EDITORIAL TECHNIQUES. The mechanics of editing and preparation of report manuscripts as recommended by the Water Resources and Publications Divisions are discussed in detail and work exercises emphasize major points. Location: Water Resources Division Training Center, Denver, Colorado.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

	Attendees: Editorial clerks and others who are actively assigned, or about to be assigned, to the editing of district or project reports. Participation will be limited to 16.
April 22-26	Description: ILLUSTRATIONS TECHNIQUES. Techniques for preparation of illustrations and visual aids are explored in depth. Special sessions are held in the Branch of Technical Illustrations. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Draftsmen, cartographers, or illustrators who presently are assigned, or about to be assigned, the duties of preparing maps, graphs, and other illustrations for district or project authors. A maximum of 16 attendees will be permitted.
April 29-May 2	Description: ANALYTICAL METHODS TO DETERMINE AQUIFER PROPERTIES AND TO PREDICT AQUIFER RESPONSE. The course is designed to acquaint or refresh field personnel with current analytical methods used in the ground-water discipline. Methods of analyzing bounded, leaky, anisotropic, layered, and unconfined aquifers will be described by staff specialists, and exercises will be worked by the class participants. Special problems in aquifer-test analysis and prediction of aquifer response will be discussed. Analysis of observation-well data near streams, and of stream-aquifer interactions will be stressed. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Field personnel with a basic understanding of aquifer mechanics and aquifer-test analysis, but with a need for additional knowledge on analytical methods of aquifer analysis. Attendees should at least be familiar with the use of the Theis equation for analyzing aquifer tests and predicting drawdowns. Attendance will be limited to 24.

TABLE 2.--DESCRIPTION OF TRAINING COURSES--continued

May 13-24	Description: ADVANCED GROUND WATER COURSE. A 2-week advanced seminar given by selected Water Resources Division specialists to update experienced field scientists in the latest concepts and techniques of the ground-water discipline. Concentration will be on (1) quantified geology, (2) ground-water mechanics, (3) geochemistry of ground water, and (4) modeling and simulation techniques for data analysis and representation. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: Professional personnel with considerable ground-water experience and considered to be senior ground-water specialists, or potential specialists, in district or project offices of the Water Resources Division. Maximum attendance will be 30. Nominations will be made by the Regional Hydrologists.
June 12-14	Description: FLOOD MAPPING FROM AERIAL PHOTOGRAPHY. This course is designed to train WRD personnel in the newly developed techniques for delineating flooding from aerial photography. Techniques for obtaining emergency flood photography for processing and mosaicing the photography for delineating the extent of flooding and for dissemination and publication of the flood maps will be described in detail. Demonstrations and exercises will be used to train each participant in the actual techniques and processes involved. Approximately one-half of the course will be devoted to practical exercises aimed at developing sufficient competence in each participant to enable him to assume responsibility in his District for carrying out this type of emergency flood mapping. Location: Water Resources Division Training Center, Denver, Colorado. Attendees: This course is open to all WRD professional personnel, but especially to those District personnel normally involved in flood work. No special previous training or knowledge is required, except the ability to see stereoscopically. Attendance will be limited to 16.

TABLE 3.--VIDEO-TAPE AND CORRESPONDENCE-COURSE TRAINING

Video-Tapes	Description: The Training Center has a multi-camera television system for recording the training courses presented at the Center. A portable battery-powered system is used to record selected field activities. The video tapes are for 1/2-inch helical scan video recorders (such as Sony AV 3600 and AV 3650). The video tapes that are available from the Training Center are listed in the publication entitled, "U. S. Geological Survey, Water Resources Division, Videotape Catalog, 1973". The tapes are on file at the Water Resources Division Training Center, Denver, Colorado and may be received on a limited-time loan by written request to that office. Information on the availability of any tape may be obtained by calling the Training Center (FTS 303 234-2600).
Correspondence Course	Description: THE MECHANICS OF FLUIDS. An advanced correspondence course in fluid mechanics. Location: Courses may be obtained from the Chief, Manpower Section, Washington, D. C. Attendees: Professionals having at least one basic course in hydraulics or fluid mechanics. Personnel from agencies other than the U.S. Geological Survey also may enroll in this course.

TABLE 3.--VIDEO-TAPE AND CORRESPONDENCE-COURSE TRAINING--cont.

Correspondence Course	Description: ELEMENTARY STATISTICS IN HYDROLOGY. An introductory course relating statistics to hydrologic applications. Location: Courses may be obtained from the Chief, Manpower Section, Washington, D. C. Attendees: Anyone desiring a basic understanding of statistics as applied to hydrology. Personnel from agencies other than the U.S. Geological Survey also may enroll in this course.